Postharvest disease management

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Postharvest disease management

I. The postharvest fungal pathogens
II. Strategy of postharvest disease control
III. Methods for applying postharvest treatments
IV. Alternative methods to control postharvest diseases

The fungal pathogens

Pome fruits

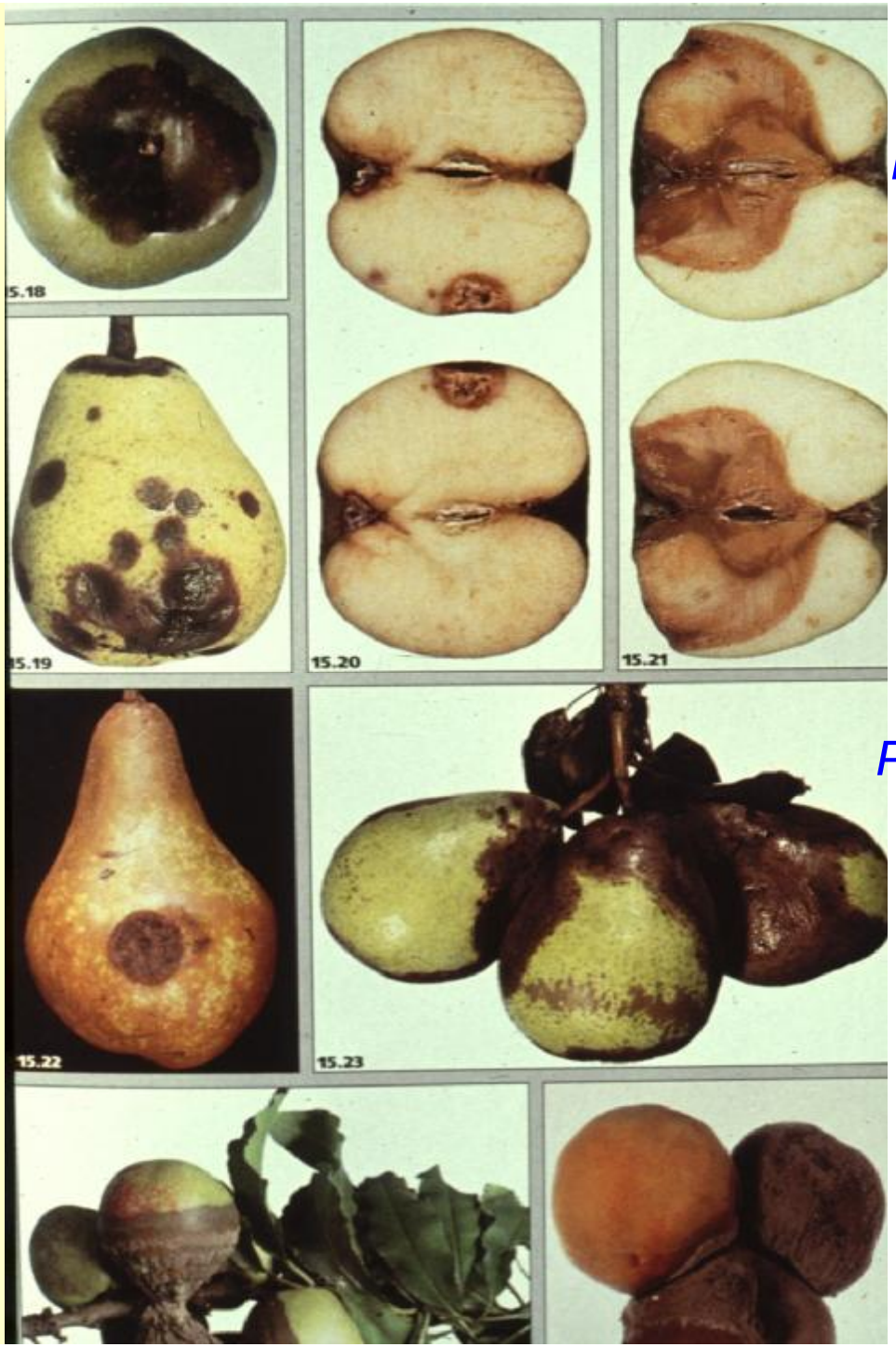
- Blue mold *(Penicillium expansum. P. verrucosum)*
- Gray mold *(Botrytis cinerea)*
- Apple and pear scab *(Venturia inaequalis, V. pyrina)*
- Dry core rot *(Alternaria, fuzarium* and *Cladosporium)*

Alternaria

Cladosporium

Phyalophora

Monilinia



Phomopsis

Phytopthora

Monilinia

The fungal pathogens

Stone fruits

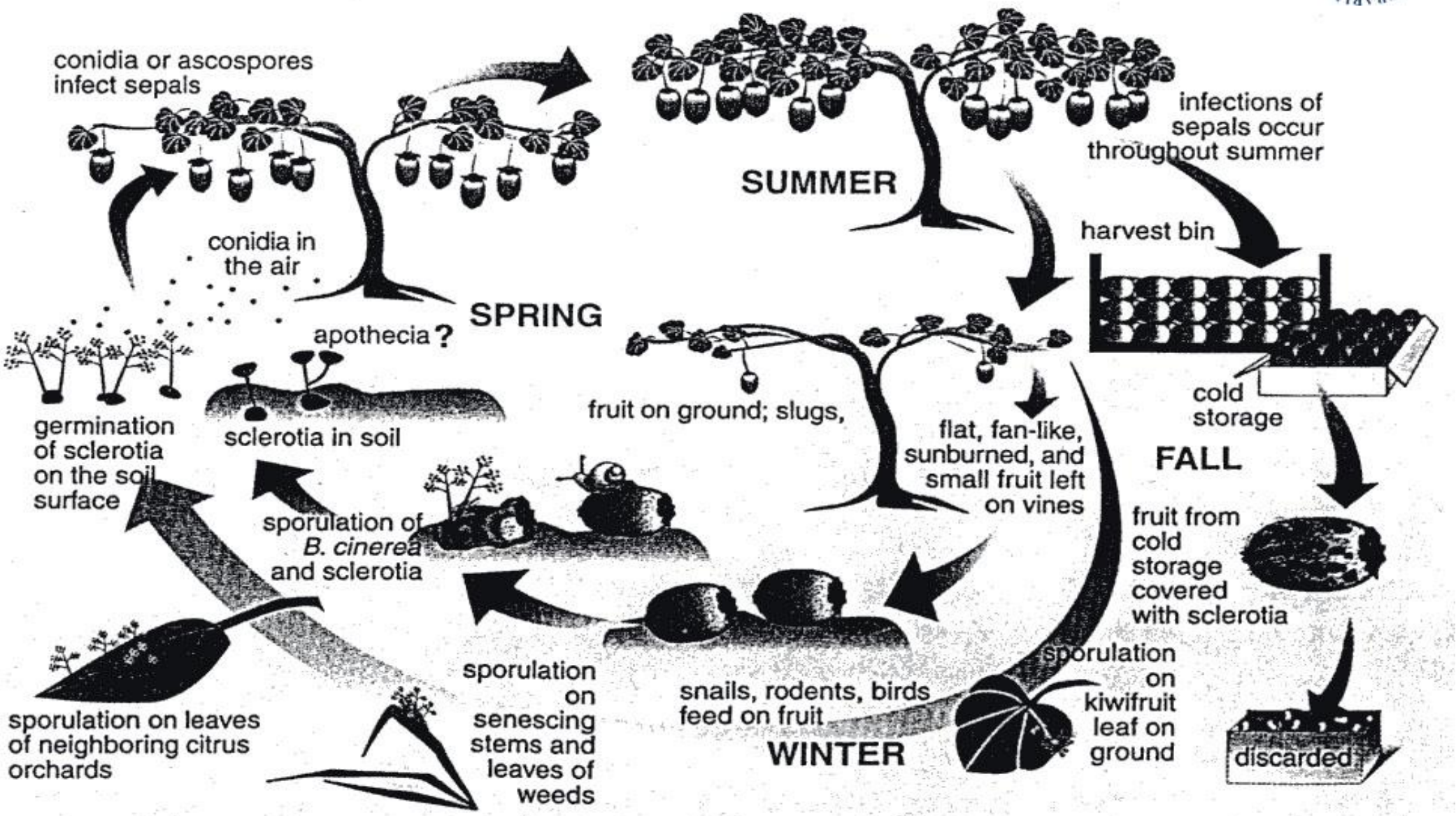
- Brown rot *(Monilinia fruticola)*
- Gray mold *(Botrytis cinerea)*
- Rhizopus *(Rhizopus stolonifera)*
- Blue mold *(Penicillium expansum)*
- Alternaria rot *(Alternaria alternata)*

The fungal pathogens

Kiwifruit

- Botrytis-(gray mold) rot *(Botrytis cinerea)*
- Dothiorella rot *(Dothiorella grecaria Sacc.)*
- Blue mold *(Penicillium expansum)*
- Alternaria rot *(Alternaria alternata)*

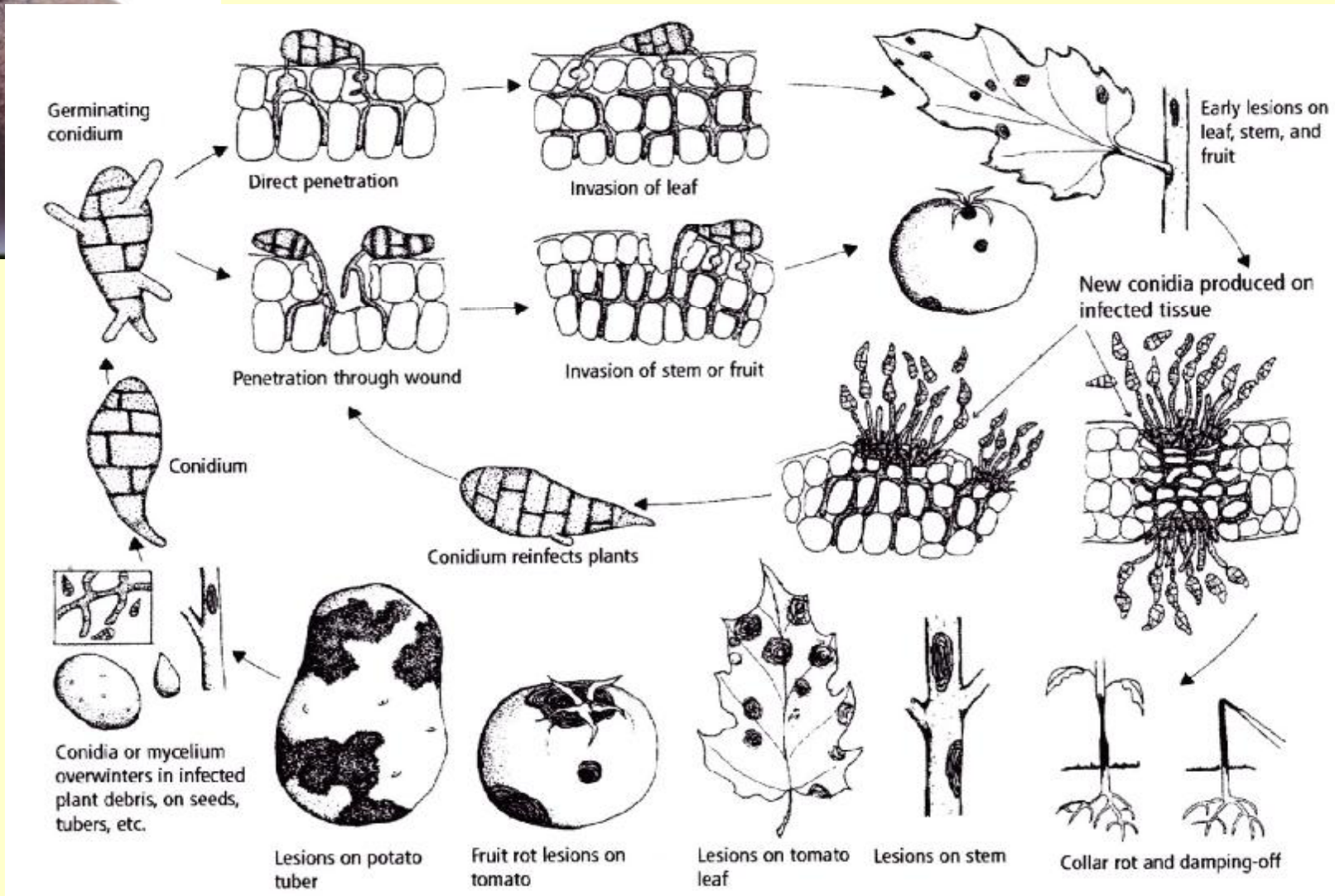
Life cycle of *Botrytis cinerea*



Gray mold rot *(Botrytis cinerea)*

Botrytis cinerea in kiwifruit

Kiwifruit Alternaria rot *(Alternaria alternata)*

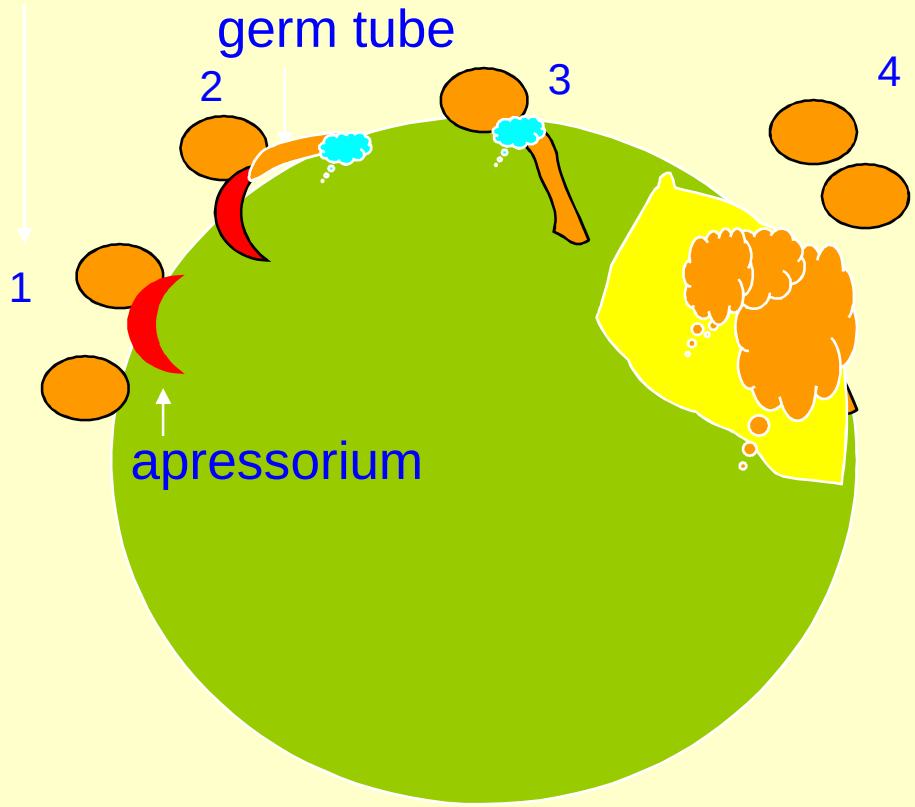


The postharvest fungal pathogens

- The postharvest diseases
- The infection process

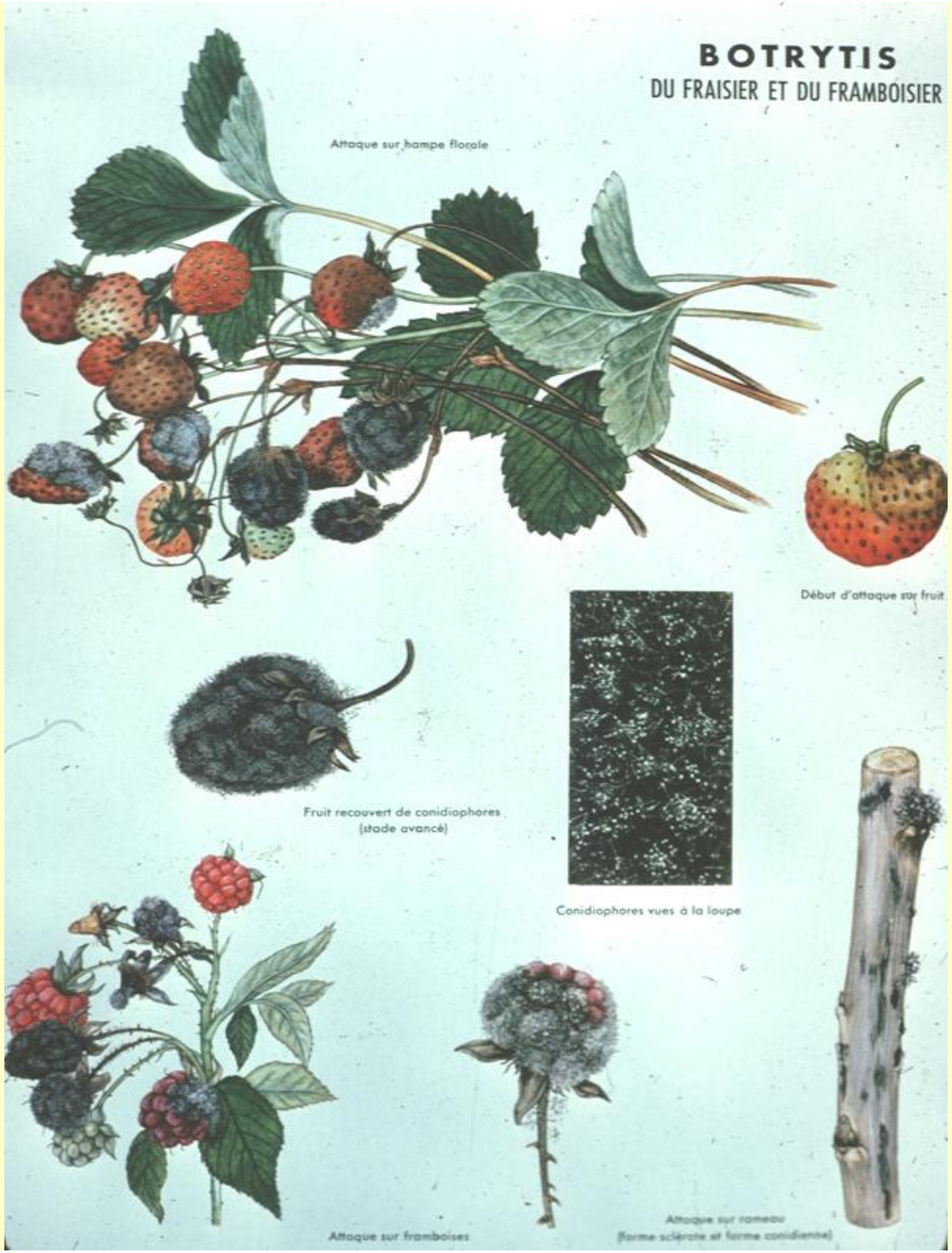
1. Spore germination (C°, H_2O, O_2, CO_2, Org. compounds)
2. Initial fruit penetration
3. Tissue invasion and rotting
4. Sporulation

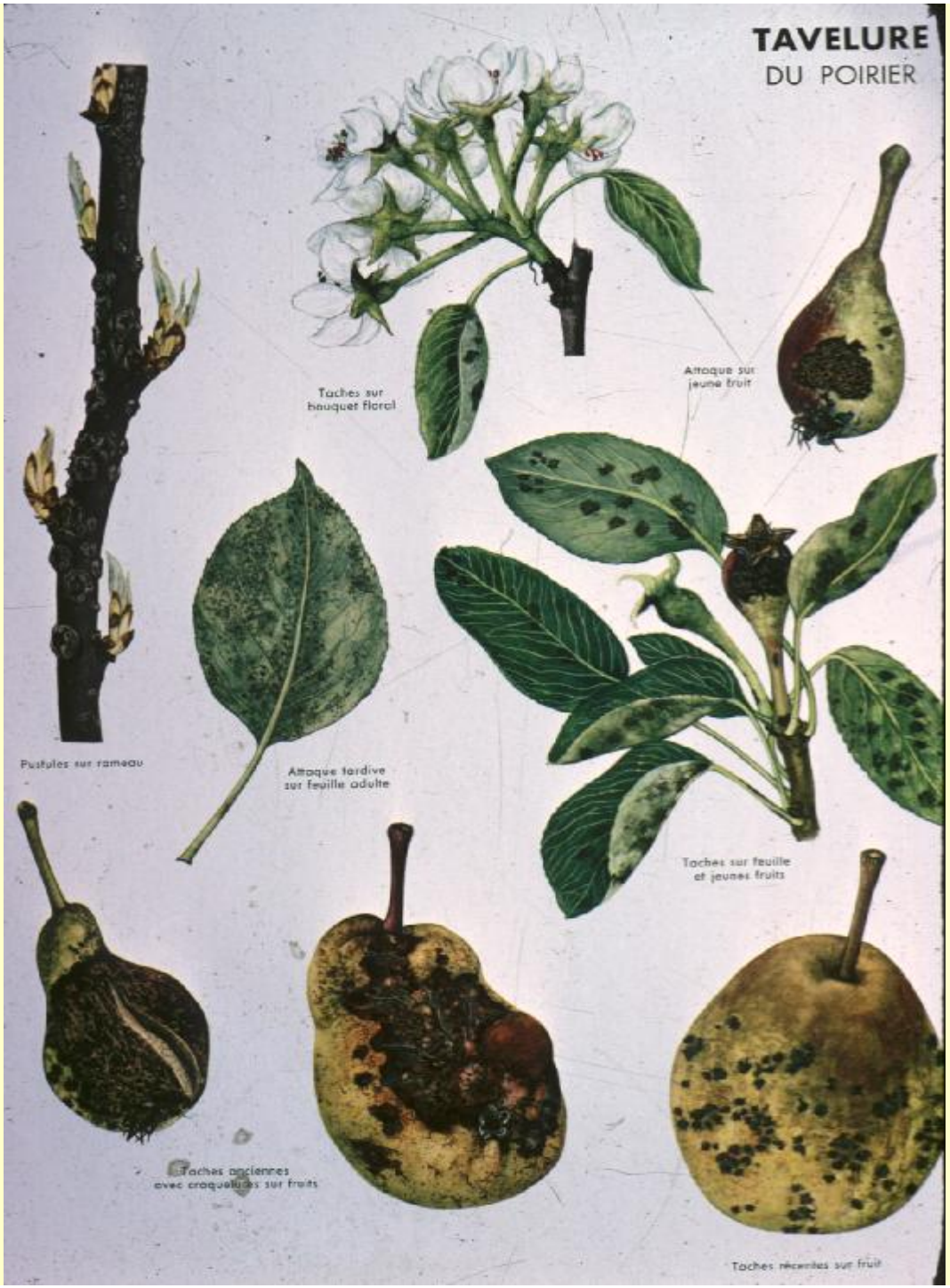
Spores landing upon a fruit, when temperature and humidity are satisfactory, germinate in a few hours by sending out a germ tube



Appressoria produced on short germ tubes of sickle-shaped conidia of *Colletotrichum* sp.

BOTRYTIS
DU FRAISIER ET DU FRAMBOISIER




TAVELURE
DU POIRIER
Taches sur
bouquet floral
Attaque sur
jeune fruit
Pustules sur rameau
Attaque tardive
sur feuille adulte
Taches sur feuille
et jeunes fruits
Taches anciennes
avec craquelures sur fruits
Taches récentes sur fruit

Principles of disease suppression by handling practices

Resistance to fungal attack

Maturity and biochemical defence

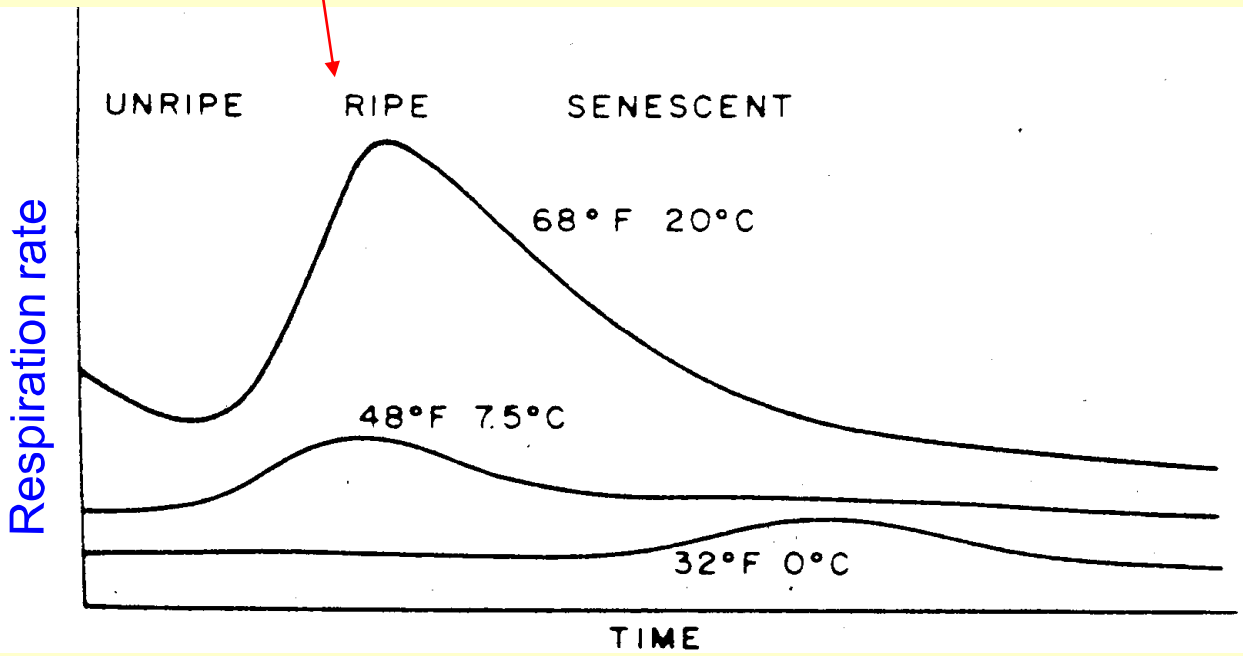
- Immature fruit- high degree of resistance is maintained until the fruit approaches maturity
- Resistance is reduced as the fruit begins to ripen
- Fruit resistance is lost during senescence

Examples: *Monilinia fruticola, Botrytis cinerea, Rhizopus* spp, *Penicillium expansum*

Physiological stage

unripe fruit-resist to fungal attack

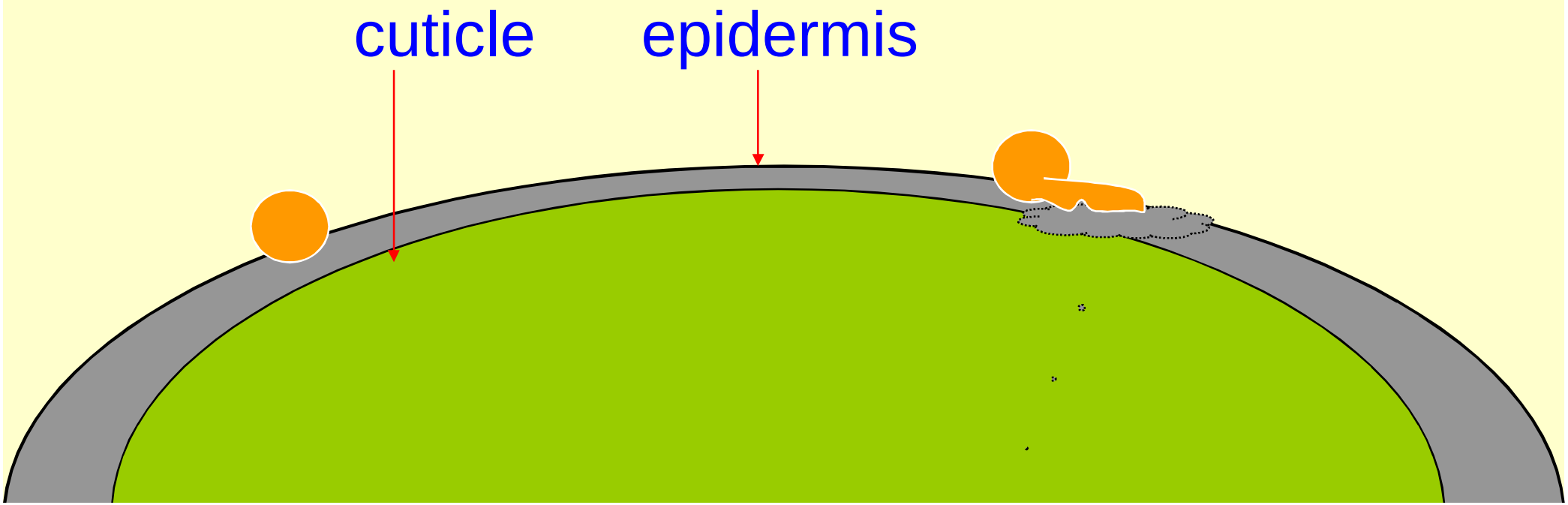
After climacteric of respiration
reduction in the fruit resistance
to pathogens



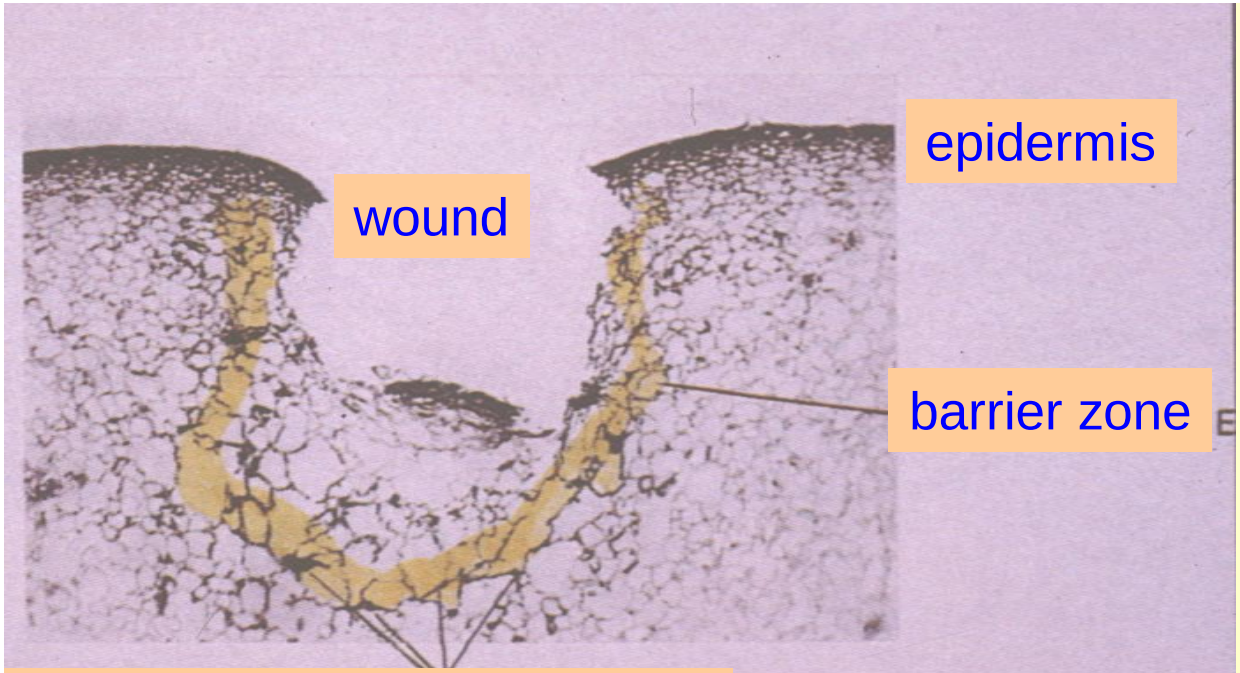
Effect of temperature on suppression and delay of respiration rise of climacteric fruits

Resistance to fungal attack

- Maturity and biochemical defence
- Nature of biochemical defence
- Wound healing



Anatomical - morhological characteristics



Lignified cell wall resist fungus penetration

Resistance to fungal attack
Nature of biochemical defence

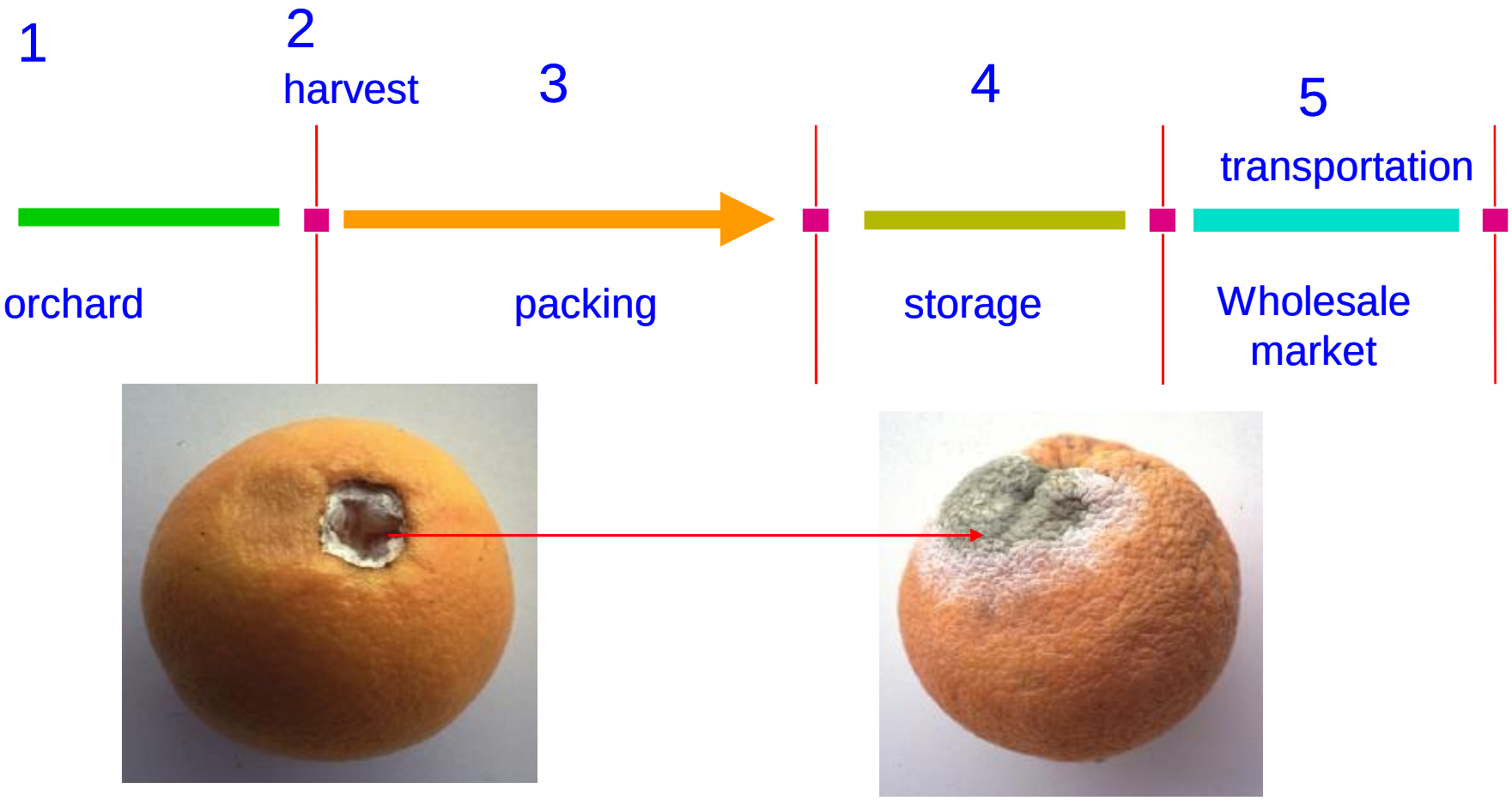
Wound healing

Cuts and punctures-avenues for infection by fungal spores

Biochemical wound healing process

Wounding induces metabolic changes:

- increase of respiration,ethylene production
- enzymatic oxidation (polyphenol oxidase+polyphenol) ---> browning
- new compound are formed-high toxic to fungi



Cuts and punctures avenues for infections

Resistance to fungal attack

Nature of biochemical defence

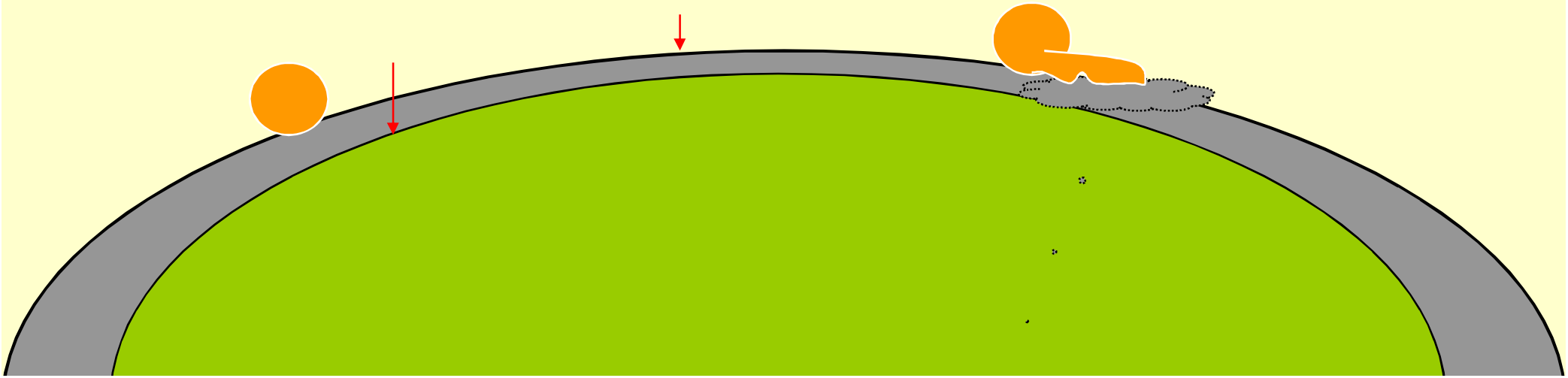
Fungi-toxic compounds already present

(polyphenols, tannins)

Formed fungi-toxic compounds against invading fungus

when a penetrating fungus elicits a reaction to produce

a toxic compound termed phytoalexins



Environmental factors

The role of postharvest environmental factors

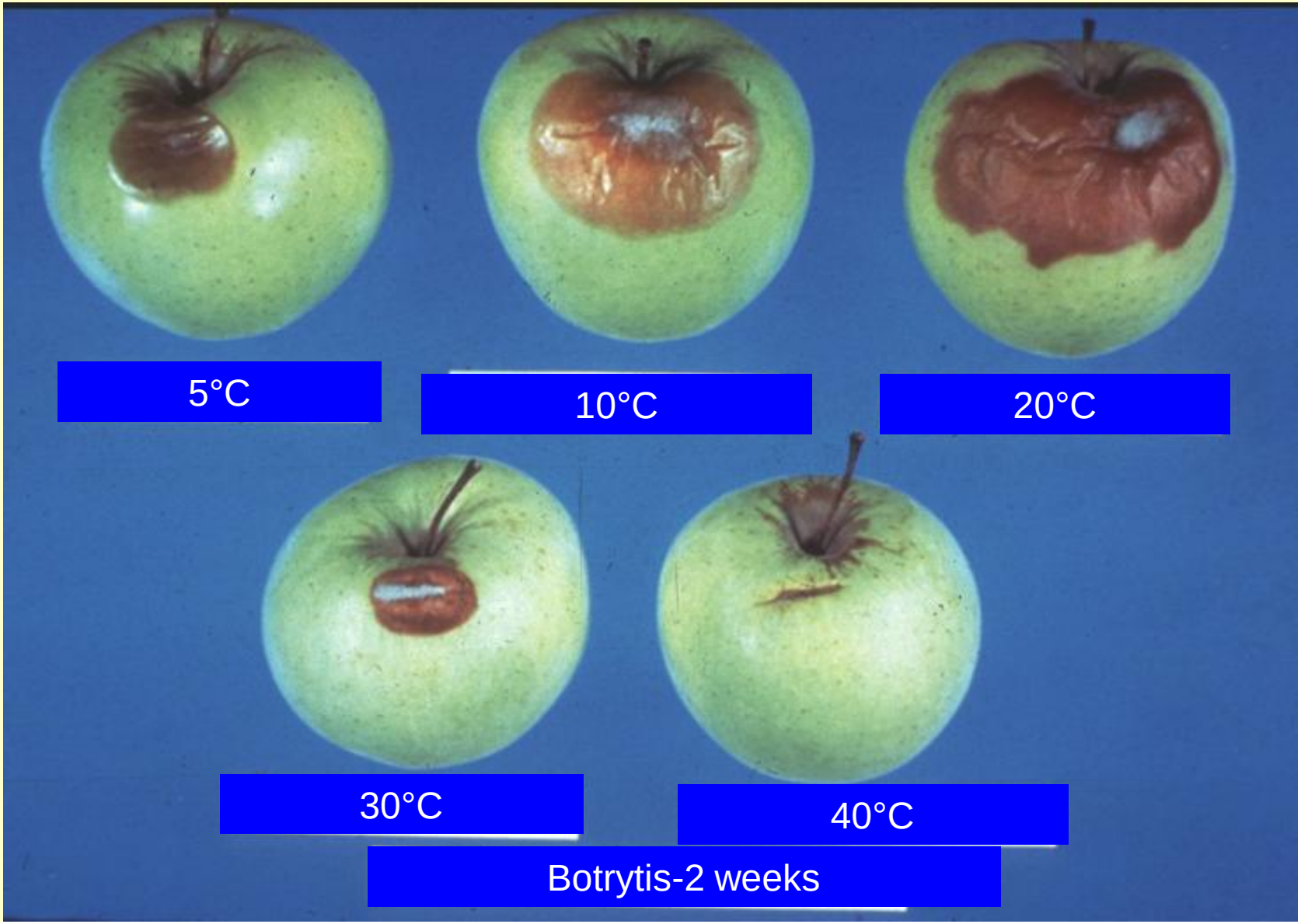
- Temperature
- Relative humidity
- Ethylene
- CA / MA

The role of temperature

Temperature requirements of postharvest pathogens

The role of temperature

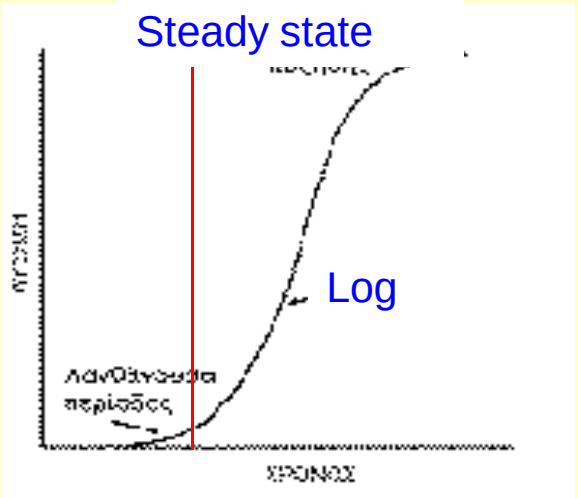
Fungal sensitivity to cold (minimum for growth -5° to -2°C)



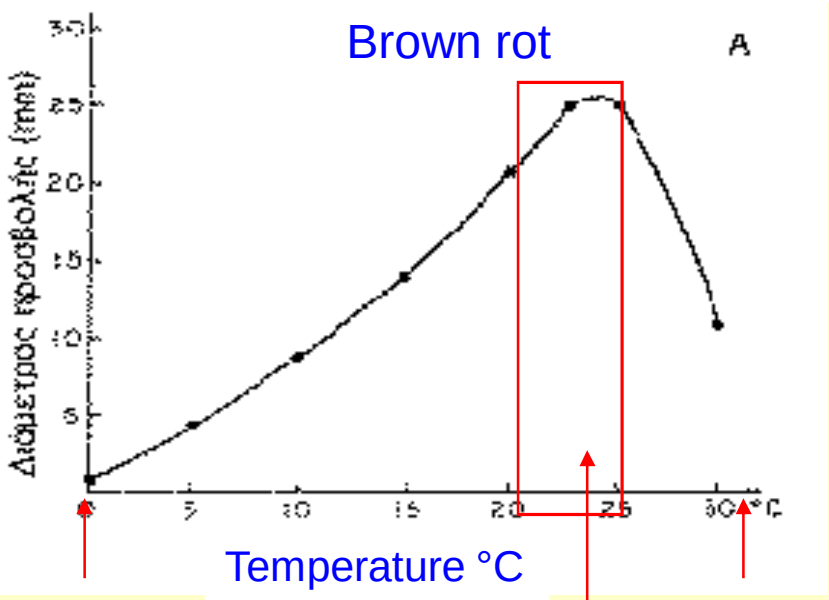
The role of temperature

Significance of sigmoid growth curve

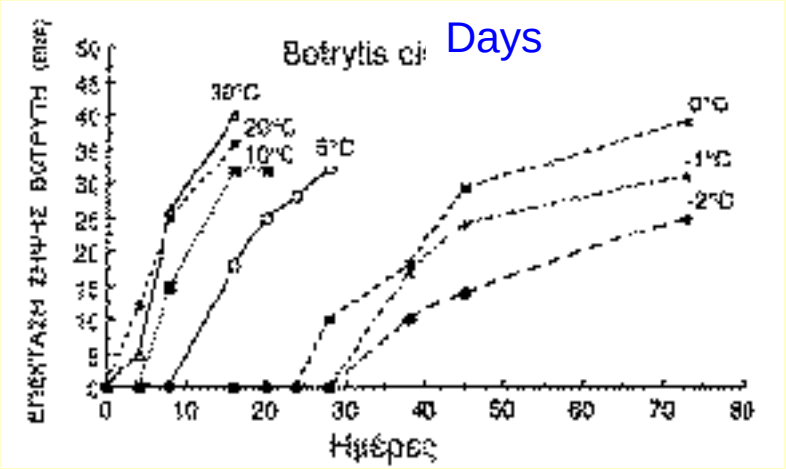
Sigmoid curve of rot development



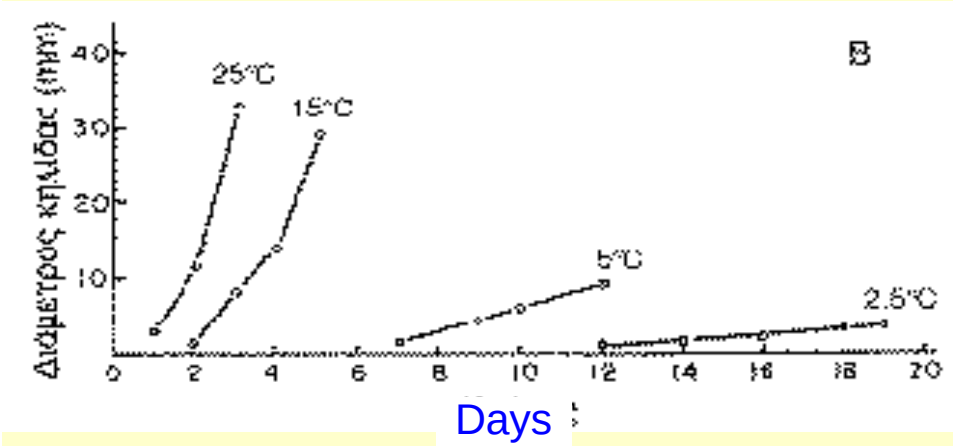
Lag phase
(hours, days, weeks)



Botrytis cinerea



Brown rot *(Monilinia fruticola)* in peaches



Environmental factors

The role of postharvest environmental factors

- Relative humidity

Environmental factors

The role of postharvest environmental factors

- Ethylene

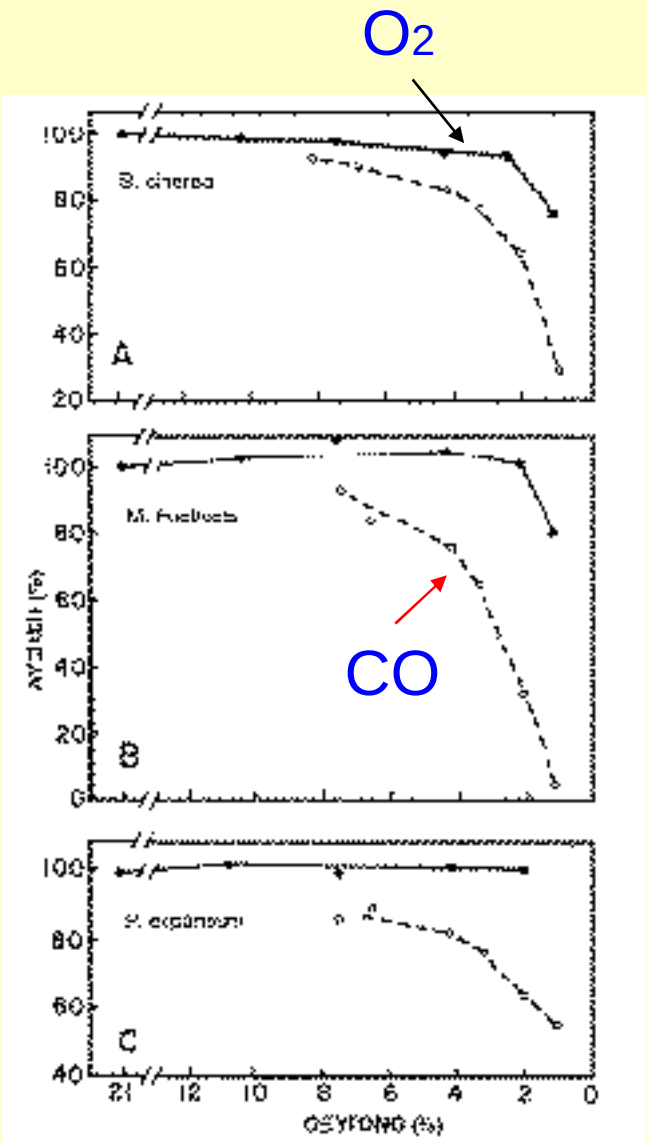
Environmental factors

The role of postharvest environmental factors

CA / MA

- Low oxygen
- High carbon dioxide
- Combined low oxygen, high carbon dioxide
- Controlled atmosphere with carbon monoxide

Suppression of stone fruit posthatvest pathogens by O2 alone
or combined with 10% CO

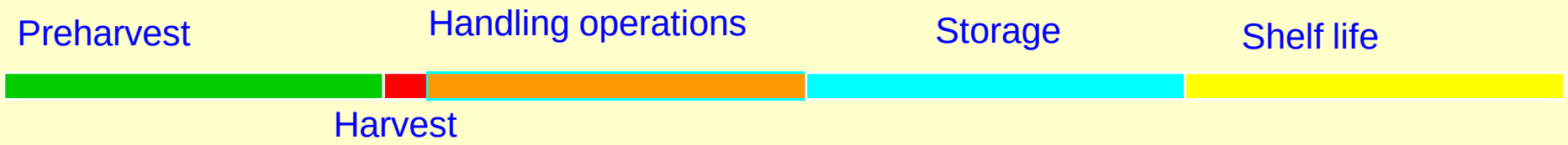


Strategy of postharvest disease control

Prevention of infection

Eradication or attenuation of established pathogen

Resistance to fungal attack



Strategy of postharvest disease control

Prevention of infection

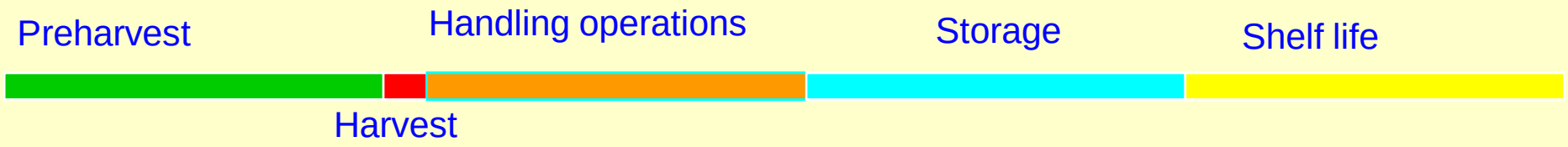
Reduce the number of injuries and of pathogen propagules

Sources of inoculum:

- containers
- water for postharvest handling operations
- the atmosphere of the packinghouse
- brushes and conveyor belts

Chemical treatment to reduce the level of inoculum on the host and the environment

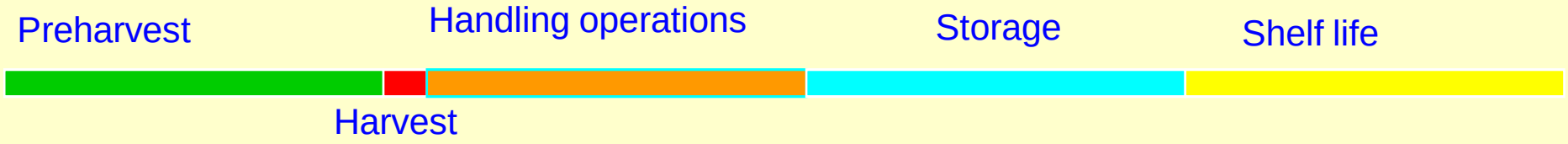
Chemical treatments to control infection after harvest



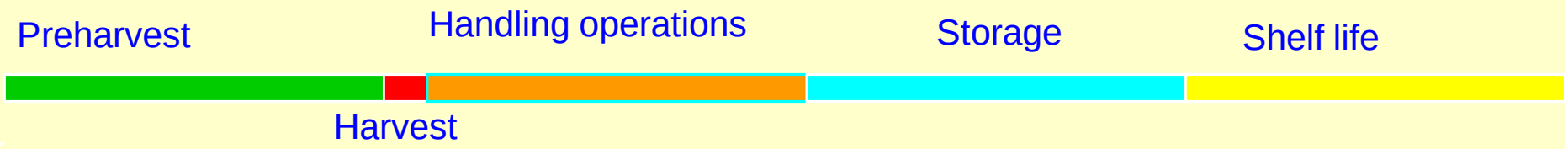
Strategy of postharvest disease control

Eradication or attenuation of established pathogen

- Chemical treatments
- Heat treatments
- Irradiation
- Low temperature storage
- Resistance to fungal attack



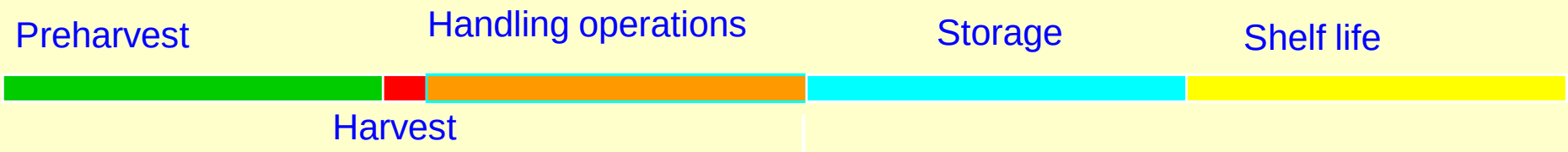
Disease management



At grower level

- Good sanitation in the field
- Field sprays
- Correct management of the crop

Disease management



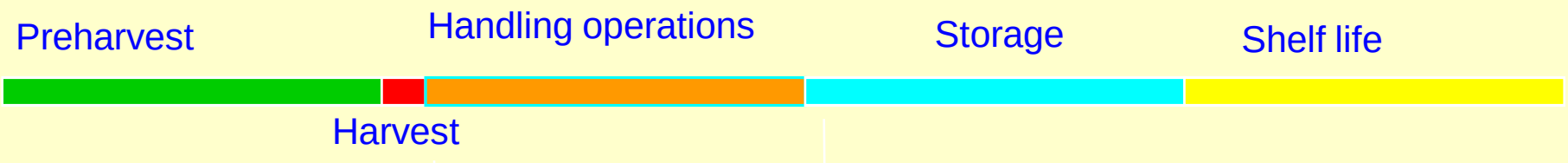
In the packinghouse

to minimize fungal infections

Sanitation and cleanliness by:

- remove and dispose the decayed fruit
- sweep the floors
- steam-clean the grading equipment (at the beginning of the seazon)
- chlorine-clean the belts and roller conveyors (each day)

Postharvest Disease and Disorder management



In the packinghouse

to minimize fungal infections

Postharvest control by approved fungicides before storage

- Liquid formulations and wettable powders
- Fumigants

to minimize physiological disorders

- Antioxidants and growth regulators

Postharvest- applied agrochemicals

Postharvest disease management

Methods for applying postharvest treatment

- Gases and airborne particulates
- Solutions, suspentions, and emulsions
- Barriers to the spread of disease

Methods for applying postharvest treatment

Gases and airborne particulate

- Fumigants
- Smokes, fogs and dusts

•Fumigation is the best method to apply fungicides to the harvest crop (strawberries, grapes)-cannot be treated in another way

•Method to apply periodically fungicides (lemons, grapes) for long periods of time in storage

•Method convenient for means of treating film-wrapped units of fruits and vegetables

Time X concentration

Methods for applying postharvest treatment

Solutions, suspentions, and emulsions

factors influencing the effectiveness of the postharvest fungicide

- fungicide concentration
- surfactant
- temperature
- pH
- contact time
- presoaking

Postharvest disease management

Methods for applying postharvest treatment

Barriers to the spread of disease

Postharvest disease management

Alternative methods to control postharvest disease

Biological control

Volatile compounds

- sulfur dioxide fumigation
- essential oils

Thermal treatment

- water treatments
- moist air

Edible coatings

Modified Atmosphere Packaging

Combination of the above methods (hurdle technology)

Postharvest management to control physiological disorders ?